

## **Review of Monteiro and Morin:**

### **Multi-decadal evaluation and analysis of past winter temperature, precipitation and snow cover information over the European Alps from reanalyses and climate models**

#### **General comment:**

This is a very relevant study, which compares in a particularly comprehensive way data sets of winter temperature, winter precipitation, and snow depth (or the derived variable of snow cover duration) for the Alpine region. The data sets are on the one hand products derived from station data, satellite products, reanalysis data and climate simulations. Such a comprehensive and in-depth comparison is, to my knowledge, unique and of great value to the cryospheric research community but also well beyond. Since the Alps are characterized by a high density of measurements, satellite products, modeling studies, and investigations of spatiotemporal changes, the results can be considered as a benchmark of comparison between observational data and model results for mountain regions.

#### **Minor comments:**

I have only several minor comments or suggestions for improvement:

Title: The title could be more concise. Actually, it is more a comparison of the data sets (as it is also written in the abstract) than an evaluation. I suggest also to make clear in the title that all climate variables studied have as reference the winter period (so also for precipitation). Also, instead of "snow cover information", one could use "snow depth information" to make clear that the study refers to the quantity "snow depth" as well as quantities derived from it.

Proposal for the title: "Comparison and analysis of winter temperature, winter precipitation and snow depth variables in the European Alps from multiple datasets".

#### **Abstract:**

The data on trends in snow cover duration given in the abstract are altitude dependent (as will be shown later in the paper), so giving a range of variation rather than a fixed value would be more accurate and clearer to the reader.

From the sentence "Reference datasets and some of the evaluated datasets provides past trends in line with current available literature" it remains unclear what is meant. Which datasets were evaluated? (In this study or elsewhere).

I find the altitude dependencies of the trends (elevation dependent climate change) for temperature, precipitation and snow sizes a relevant result and suggest to include it in the abstract as well.

#### **Objective of the study as described in the introduction section:**

It is stated (page 4/118-120): *The objective of the present study is to compare the performance of different datasets from different modelling strategies in the European Alps, in order to provide the best possible estimate of the state of the snow cover, and its first order drivers, wintertime near surface temperature and precipitation.*

I recommend to rethink if this is really the main objective:

- best possible estimate of state of snow cover (and its first order drivers)
- comparison of the performance of different datasets from different modelling strategies

If the objective is really for best possible estimate then this aim should be more reflected in the conclusions. Moreover, comparison includes not only the modelling data. I guess, this is certainly already a special fine-tuning of the study, but it would strengthen the work once again.

#### **Data and methods:**

##### 2.4.4 Time periods, statistics and trend analyses

Please clarify in the formula for correlation what the "n" means.

#### **Conclusions**

Another suggestion from my side concerns the Conclusions. My impression about this is that the paper does very nicely the comparison between the different datasets and also shows the spatiotemporal trends of the datasets for temperature, precipitation and different snow variables, but the conclusions from this are still somewhat open. I totally agree with the statement that none of the datasets outperforms the others. But ev. it could be interesting to contrast the detected differences between the data sets with the detected trends. This could be done either in a figure (however there is already an extremely high supply of figures and should not be enlarged) or purely textual, where the latter is probably easier to do.

#### **Figures:**

Figure 1 caption: ... at 1km and contour of the Alpine Convention outline of the Alps and the four ....

For Figures 7, 8, 9 14, A1, A2, A3 it would be helpful for the reader if the structure of the three altitude bands would be more emphasized in a graphic way. For some of the Figures, one could get the impression that the Y-axis is a continuous representation of the altitude (but defacto it is only an indication of the altitude bands).

To some of the Figures the font size is already very small and it is not easy to read (but ev. it still meets the Copernicus requirements)

I recommend to improve the language quality by looking for repetition of words and some spelling errors as well as simplifying sentence order / improving readability.

Example e.g. page 4 last paragraph : We investigate ... We take .... We also exploit .... By doing so, we aim ...